



Federated Wireless, Inc.
4301 North Fairfax Drive
Suite 301
Arlington, VA 22203
www.federatedwireless.com

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VIA ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Notice of Ex Parte - *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band* - GN Docket No. 12-354

Dear Ms. Dortch:

On April 6, 2015, Kurt Schaubach of Federated Wireless, Inc., and Jennifer Richter and Benjamin Bartlett, the company's counsel, met with John Leibovitz, Brian Regan, and Paul Powell of the Wireless Telecommunications Bureau, and Ira Keltz of the Office of Engineering and Technology. Mr. Schaubach, Ms. Richter and Mr. Bartlett also spoke separately by telephone with Priscilla Delgado Argeris, Senior Legal Advisor to Commissioner Rosenworcel. The discussions focused on the Commission's proposals to establish the Citizens Broadband Radio Service in the 3.5 GHz Band ("Citizens Band").¹ The attached slides also were provided in the meeting with Bureau staff.

As the Citizens Band proceeding concludes, the Commission should be gratified by the way the industry has come together to reach consensus on important issues related to the Citizens Band, including interoperability and sharing all Citizens Band spectrum – including Priority Access License ("PAL") allocations. Clearly, there is tremendous interest in unlocking the value of this spectrum, including among carriers, and moving forward with innovative uses of the band. It is a rare occasion when the interests of stakeholders from across the industry align, and true collaboration occurs, but that is happening here.

As the Commission works to finalize the Citizens Band Order, Federated Wireless emphasizes the following points.

I. The Commission has made good decisions, to date, on how General Authorized Access ("GAA") spectrum will be made available to Contained Access Facilities ("CAFs"), finally addressing pent up demand for LTE-based wireless broadband in CAFs.

Only 1% of CAFs nationwide have internal access to LTE-based wireless broadband today, notwithstanding that technology for in-building solutions has existed for years. The Commission's CAF proposal will provide a mechanism for affordable and robust internal wireless broadband for hospitals, governments, utilities, schools, manufacturing, and other buildings above a certain size. It

¹ See *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Further Notice of Proposed Rulemaking, 29 FCC Rcd 4273 (2014).

is prohibitively expensive to invest in wireless solutions for these kinds of enterprises, which has resulted in nearly all CAFs being left with inadequate internal wireless broadband solutions. The Commission knows and understands the inadequate internal wireless broadband that is available, for example, to schools, hospitals, and government buildings. This is why the Commission has proposed special provisions for CAFs in the Citizens Band, ensuring for the first time that spectrum will be available for internal wireless broadband connections.

The facts around CAF use of GAA spectrum reveal that this is a simple and valuable application of GAA spectrum that will not complicate Spectrum Access System (“SAS”) operations. No further solutions need to be developed to provide for CAF use of GAA spectrum beyond the basic functionality of the SAS. Any eligible CAF that wants to have access to CAF-GAA spectrum will need to apply for it. CAFs, however, will have no expectation of interference protection, and they will be required to reapply for their use of CAF spectrum annually. CAFs will merely be afforded 20 MHz of GAA-eligible spectrum for use within the confines of the CAF. The SAS can easily manage GAA channel assignment to the CAF while also ensuring that the same GAA spectrum is available to users outside the CAF. The indoor-outdoor RF isolation between GAA uses is quite high.

Even if the CAF location is a campus, with both indoor and outdoor components, there will not be conflicting outdoor use of GAA spectrum among CAF and non-CAF users. The spectrum will be allocated to the CAF inside the CAF, and the GAA spectrum will be made available to others for use outside the CAF. In the view of Federated Wireless, it is important that GAA spectrum for CAFs is made available both inside CAF buildings and on contiguous outdoor property. For example, utility and manufacturing plants, as well as hospital campuses, educational campuses and government campuses, all require seamless access to sufficient CAF spectrum and LTE technology, both inside buildings and between buildings, in order to support the continuous broadband needs of users in a CAF environment. As the Commission has emphasized in other proceedings, such as the E-rate proceeding, the need for broadband does not end at a building’s front doors.²

Additionally, the CAF “reserved” frequencies are not a “set aside.” Spectrum for CAFs will move around the band just as other GAA frequency assignments move around the band. CAF use is merely a specific application within the GAA tier, affording sufficient GAA spectrum inside the CAF to provide a predictable quality of service for the many users inside the CAF. CAF use of the Citizens Band will provide to schools, hospitals, utilities, governments and others certainty in investment and a predictable quality of service that they do not have today.

Commenters have suggested that CAFs can apply for PAL spectrum, but obtaining PAL authorizations is not a practical solution for most CAF users. Recent auction results, such as AWS-3, make clear that CAF users (*e.g.*, hospitals, schools, and utilities) would have to commit substantial and disproportionate sums to acquire PAL authorizations. Moreover, it would be illogical for a single building to acquire PAL spectrum in an entire census tract simply to have spectrum to serve a single building or campus location within it. General use GAA spectrum also is not a sufficient

² See *Modernizing the E-rate Program for Schools and Libraries*, WC Docket No. 13-184, Notice of Proposed Rulemaking, 28 FCC Rcd 11304, ¶ 320 (2013). See also *Modernizing the E-rate Program for Schools and Libraries*, WC Docket No. 13-184, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 8870, ¶ 7 (2014) (“Today, students and teachers can and do take their devices with them wherever they go, which means they need to have Internet connectivity throughout their schools.”). If the school is in a campus environment, that access should be available to students between buildings.

solution for CAFs because it will not provide the guaranteed bandwidth and reliability of service that users in large buildings need, thus not addressing the very problem the Commission is trying to remedy by adopting special provisions for CAFs as a benefit of the Citizens Band. More access to more unlicensed spectrum will not change the status quo. Indeed, one of the significant benefits of the CAF reservation is that when the Citizens Band is fully in use, the reservation will function to ensure that a known quantity of spectrum is available for broadband use inside CAF environments.

To date, in this proceeding, the Commission has made the right decisions for CAFs, recognizing that the wireless broadband needs of hospitals, schools, utilities and similar enterprises are not met today. The Commission should stay the course on this important application for the Citizens Band.

II. Perhaps in an effort to justify proposals for static PAL licenses, questions have been raised about how a multi-SAS environment will function and how SASs will assign frequencies, address PAL user preferences, and synchronize channel assignments, but these questions are readily solvable through technology and the standards-setting process.

The WInnForum, a multi-stakeholder SAS working group, is already hard at work addressing the functional and performance requirements for SASs that will achieve the Commission's goals for the Citizens Band. There should be no doubt that skepticism about how SASs will work, and requests for static PAL licenses, are rooted in the same place – conventional notions about the value of licensed spectrum. This is a categorical mistake because the paradigm for the Citizens Band is new. The Citizens Band, with SASs, sensing technologies, and spectrum sharing, is not intended to replicate spectrum use as it exists today in licensed bands. This new paradigm is a vehicle for innovation in spectrum sharing, not another license allocation scheme, and the potential for innovation in the band needs to be respected and given an opportunity to flourish.

As noted in the Chairman's recent blog post, innovations in cloud computing will be the cornerstone of effective SAS operation.³ Fundamentally, cloud computing enables cost-effective access to distributed computing resources, storage, analytics, and crowd-sourced data, thereby ensuring that every SAS provider has access to state of the art technology. The basic issue – how do multiple, distributed systems work together to ensure an optimal result – has been studied extensively, and models and algorithms readily exist.⁴ Further, there are numerous practical examples of how distributed systems manage synchronization, such as the hierarchical function of the internet Domain Name System, or how multiple independent systems manage the allocation and assignment of a finite resource, such as seats on an airplane or rooms in a hotel, through various travel services that are competing for the space. Additionally, the concepts of optimal frequency selection and frequency resource management have been addressed previously within the wireless industry, such as in the development of automatic frequency planning software for cellular networks.

³ See "Innovation in the 3.5 GHz Band: Creating a New Citizens Broadband Radio Service," Chairman Wheeler, FCC (March 27, 2015), *available at*: <http://www.fcc.gov/blog/innovation-35-ghz-band-creating-new-citizens-broadband-radio-service>.

⁴ For example, considerable research, models, and algorithms have been developed in the areas of computer network routing and constraint-based optimization, which are relevant here.

As a leader in small cell and sensor technology, and spectrum sharing, Federated Wireless pledges to be transparent with all interested stakeholders, sharing its SAS innovations, and making portions of its SAS technology available as open source to further facilitate coordination with users and other SAS administrators in order to ensure the success of the Citizens Band. Federated Wireless encourages other SAS administrators and technology developers for the Citizens Band to do the same.

What the Commission is creating with the Citizens Band is a long-term framework against which industry can now execute. Federated Wireless and many others are excited by the opportunity. With PAL auctions at least a year away, there is ample time, momentum and common interest among all stakeholders to define, implement and demonstrate SAS functionality and performance before complexity in the band arises.

III. It appears the Commission has reached positive solutions regarding interoperability in the Citizens Band, but continued oversight will be needed.

As emphasized in previous filings, Federated Wireless has been very concerned about interoperability in the Citizens Band, wanting to ensure not only that there is technology neutrality, but also that devices for the band work for all users of the band, and that any technology used in the band will not favor one class of users (*e.g.*, carriers) over all other users of the band. It would be a failure for the Citizens Band for carriers to have disproportionate access to the band because of technology decisions. As Commission staff has noted, the Citizens Band should not simply become an extension of the licensed bands used by the carriers, but should present a genuine opportunity for all users, through spectrum sharing and other innovations, to improve the availability and quality of broadband service. As expressed in recent *ex parte* communications, Verizon and others clearly understand the need for interoperability across the band, and this presents a real opportunity for forward progress.⁵

Federated Wireless is gratified by the resolutions the Commission has reached on interoperability, including that devices for the Citizens Band are capable of operating on any and all frequencies in the band, and that all devices for the band are capable of operating in a bi-directional mode. This is positive, but some future monitoring on interoperability may be needed.

Federated Wireless also has emphasized that the fastest path to deployment in the Citizens Band is the adoption of current and existing band classes, such as 3GPP Band Class 42 and Band Class 43, covering the spectrum from 3.4 GHz to 3.8 GHz. These band classes will offer standard LTE capabilities across the entire Citizens Band, and will achieve interoperability across the entire

⁵ See, *e.g.*, Letter from Patrick Welsh, Verizon, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-354, Notice of Ex Parte (filed March 24, 2015) (“...[W]e expressed support for the Federal Communications Commission’s ... proposal to require all Citizens Broadband Radio Service Devices ... to be tunable across the entire 3.5 GHz band.”); Letter from Aparna Sridhar, Google, Inc., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-254, Notice of Ex Parte (filed March 3, 2015) (“In order to ensure that the spectrum is fully utilized even if particular channels are occupied, the Commission should require all GAA and PA devices to operate across the entire 150 MHz of spectrum between 3550 and 3700 MHz.”); Letter from Michael Calabrese, Open Technology Institute, and Harold Feld, Public Knowledge, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-354, Notice of Ex Parte (filed March 16, 2015).

band, without the need for a new standards-setting process. Band Classes 42 and 43 will work well for the band.⁶

One reason many in this proceeding have been concerned about implementation of LAA-LTE in the band is that it could represent a 2-3 year delay for the Citizens Band. A whole new standards-setting process will be needed to create a new band class, develop a regime within which TDD-LTE and LAA can both operate, and then undertake working groups and other phases before it is ratified. This will take 2-3 years. As AT&T recently emphasized, “To get to LAA requires a 3GPP LTE standards change.”⁷ In contrast, Band Classes 42 and 43 are available today, and massive scale already exists that will result in going to market in the Citizens Band much sooner.

Furthermore, Federated Wireless is concerned about inter-band carrier aggregation and how SASs will address spectrum external to the Citizens Band. Federated Wireless is concerned about the fair use of spectrum and how inter-band carrier aggregation might impede the openness and availability of the Citizens Band for all users on an equal basis. Although aggregation of spectrum is feasible, it has to be managed by the SAS, and it is unclear how the SAS will address external bands and inter-band carrier aggregation. This issue needs to be studied further to ensure that there are not any unintended consequences for non-carrier users of the Citizens Band, whereas intra-band carrier aggregation (solely within the Citizens Band), managed by the SAS, would not pose the same concerns.

Similar to the steps taken in the AWS-3 proceeding, the Commission should use the Order in this proceeding to encourage interested parties to ensure that now, and in the future, there will be voluntary, standards-based solutions to facilitate interoperability across the entire 3.5 GHz band.⁸ The Commission should make clear that it expects stakeholders to participate in good faith in the voluntary standards-setting process to maintain interoperability in the entire band. Additionally, the Commission should emphasize that, if technical concerns arise, the stakeholders are expected to work to find reasonable measures to remedy those concerns.

⁶ As there is no guard band in the band class definitions for 42 and 43, the two bands can be concatenated to enable full use of the 3550 MHz to 3700 MHz band segment comprising the Citizens Band. As it will not be necessary for a Citizens Band end user device to tune over the entire band, the device RF front-end filter(s) and software can be modified to improve Citizens Band performance and reduce susceptibility of the receiver to overload caused by incumbent operations outside of the band. Filter and software modifications do not require a new band class definition or modifications to the baseband processor. Overload and device protection in the proximity of incumbent radar systems is a consideration for *any* Citizens Band end user device, as a radar signal located with the band or adjacent to it could have a similar impact, and the combination of device design and incumbent sensing technology will be required to fully protect devices. In short, there is no specific limitation, or added complexity, to enabling Band Class 42 and 43 in comparison to a new Band Class.

⁷ Phil Goldstein, “AT&T In No Hurry to Test and Deploy LTE Unlicensed,” FierceWirelessTech (April 1, 2015). 3GPP is currently working on standardizing LAA, but has not yet done so, “so some carriers are moving ahead with unstandardized LTE-U.” AT&T Mobility, however, is not in a rush to trial and deploy LTE-U, and would be willing to wait for a standardized version of LAA due to concerns that LTE-U may not “assure fair use to any technology vying for that spectrum.” *Id.*

⁸ See *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, GN Docket No. 13-185, Report and Order, 29 FCC Rcd 4610, ¶ 230 (2014).

Federated Wireless, Inc.
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Federated Wireless is encouraged by the progress made in this proceeding, and already has started work with carriers on standards for the Citizens Band through the WInnForum. The company looks forward to continuing this work to achieve the Commission's goals for the Citizens Band.

Respectfully submitted,

_____/s/
Kurt Schaubach
Chief Technology Officer
Federated Wireless, Inc.

cc:
Priscilla Delgado Argeris
John Leibovitz
Brian Regan
Paul Powell
Ira Keltz

Implementing the Three Tier Spectrum Sharing Framework in the 3550 MHz Band

April 6, 2015

Priority Access License (PAL) Tier

- PAL user requirements can be satisfied without increasing Spectrum Access System complexity
 - PAL user registers PALs with a SAS Administrator
 - PAL user further defines spectrum use policies through registration process, or policies can be auto-defined by SAS Administrator
 - Spectrum use policies (e.g., channel assignment priorities, geographically contiguous licenses, contiguous frequencies) stored in database maintained by each SAS Administrator
 - Policies synchronized among SASs through standards-based SAS-to-SAS interfaces and protocols. Operational procedures (data updates, privacy, etc.) can also be standardized
- Changing the PAL frequency in an operational network is straightforward
 - Frequency assignments will follow industry-defined channel plan, devices must tune over entire band
 - Standards-based interfaces between SAS and PAL user network to communicate frequency changes
 - Existing 3GPP standards and LTE network operational methods currently provides various techniques to transition LTE eNodeBs and UEs from one frequency to another
- All PALs must be managed by SASs to fully protect incumbents
 - Goal is to reduce dynamism of PAL frequency reassignments while satisfying PAL user requirements

General Authorized Access (GAA) Tier

- Assignment of unused PAL frequencies for GAA use increases spectrum utilization
 - All CBRS users stand to benefit
 - PAL users will not experience additional interference or unnecessary delays in accessing its PAL spectrum
 - Actual use of PALs is known as each PAL user registers CBSD installations with SAS Administrator
 - SAS can utilize RF modeling and/or sensing data to establish sharing based on co-channel and adjacent-channel protection criteria
 - PAL usage data synchronized among SASs ensuring dynamic release of PAL spectrum
- Aggregation of GAA spectrum is feasible so long as SAS spectrum management principles remain in effect
 - Anchor for spectrum aggregation should be within CBRS band, so spectrum use is fully managed
 - SAS should ensure available GAA spectrum is fairly allocated among users, aggregation should not enable GAA spectrum to be “monopolized” by certain users and/or access technologies
- Contained Access Facility uses can be readily managed by the SAS
 - No more complex than managing GAA channel assignments generally, and won't compromise the spectrum available to the GAA pool outside of the CAF location

Three Tier Sharing Framework

- Goal should be to accelerate time-to-market for the CBRS band
 - Effect rapid implementation of the three tier sharing framework
 - Focus first on the most straightforward use cases, such as the Contained Access Facility
- Begin with the existing 3.5 GHz LTE ecosystem
 - No need to wait for new standards
 - Band Class 42 (3400 MHz – 3600 MHz) and Band Class 43 (3600 MHz – 3800 MHz) already in commercial use in portions of ITU Region 3 and candidate bands for IMT designation elsewhere in ITU Region 2
 - Use of BC42/BC43 meets device interoperability requirements
 - Deployments can begin in GAA tier, transitioning to PALs as the licenses are later auctioned
- Implement other LTE technology as it develops
 - CBRS-specific band classes and other technology can easily overlay on existing BC42/BC43 based deployments